CBCS SCHEME

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18CV81

Eighth Semester B.E. Degree Examination, June/July 2025
Design of Pre-Stressed Concrete

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Distinguish between pretensioning and post tensioning. **(06 Marks)**

b. Explain the need for High strength concrete and higher grade of steel for PSC members. **(06 Marks)**

c. Explain with a neat sketch "Hoyer's Long Line" system of pre-tensioning. **(08 Marks)**

OR

2 a. Explain load balancing concept. **(08 Marks)**

b. A PSC beam support live load of 6 kN/m over a SS span of 8 m. The beam has an I section having an overall depth of 600 mm and 200 mm wide flanges @ top and bottom. The thickness of web and flanges are 80 mm. Find the magnitude of the prestressing force with an eccentricity of 80 mm, which balances the stresses due to dead and live loads at bottom fiber of the central section of the beam. **(12 Marks)**

Module-2

3 a. List the different types of losses in pre-tensioning and post-tensioning of PSC members with necessary formulae. **(08 Marks)**

b. A PSC beam of 200 mm × 300 mm is prestressed with wires of area 300 mm^2 located at an eccentricity of 100 mm below centroidal axis at midspan and zero at supports. Initial prestress in the wires is 1 kN/mm^2. The span of the beam is 10 m. Calculate the loss of prestress and total percentage of loss of prestress in wires if

i) Pre-tensioned

ii) Post-tensioned, using the following data:

Grade of concrete M40

$E_S = 210\ kN/mm^2$

Shrinkage strain in concrete for pretensioned member = 300×10^{-6}

Age of concrete at transfer for post tensioned beam = 8 days

Creep coefficient = 1.6

Slip at anchorage = 2 mm

Coefficient of friction between concrete and cable duct = 0.55

Friction coefficient for wave effect = 0.0015/m. **(12 Marks)**

OR

4 a. How do you estimate the loss of prestress due to

i) Elastic deformation ii) Shrinkage of concrete

iii) Creep of concrete iv) Relaxation of stress in steel. **(08 Marks)**

b. A concrete beam AB of span 12 m is post-tensioned by a cable which is concentric at supports A and B and has an eccentricity of 200 mm in the mid-third span with a linear variation towards the supports. If the cable is tensioned at the jacking end A, what should be the jacking stress in the wires if the stress at B is to be 1000 N/mm^2? Assume the coefficient of friction between the cable duct and concrete as 0.55 and the friction coefficient for the wave effect as 0.0015/m. **(12 Marks)**

Module-3

5 a. What are the different types of flexural failures observed in PSC members? **(08 Marks)**

b. A pretensioned T-section has a flange which is 300 mm wide and 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross-section is 500 mm. Given $A_p = 200$ mm^2, $f_{ck} = 50$ N/mm^2 and $f_p = 1600$ N/mm^2. Estimate the ultimate moment capacity of the section using IS codal provisions. **(12 Marks)**

OR

6 a. A PSC concrete girder of box section 1 m by 1 m overall dimension has a uniform wall thickness of 200 mm. The girder is post – tensioned by high tensile wires of area 2250 mm^2 located at an effective depth of 900 mm. If $f_{ck} = 40$ N/mm^2 and $f_p = 1600$ N/mm^2. Calculate the ultimate flexural strength of the box girder section. **(10 Marks)**

b. A post tensioned unbounded beam section 120 mm × 300 mm is prestressed by 7 wires of 5 mm diameter with an effective cover of 50 mm and effective stress of 1200 N/mm^2. The beam is of 7.5 m span. If M40 concrete is used and $f_p = 1600$ MPa, find the ultimate flexural strength of section. **(10 Marks)**

Module-4

7 a. Explain the shear failure in PSC members. **(08 Marks)**

b. A PSC beam of span 10 m has a rectangular section 120 mm wide and 300 mm deep is prestressed by a curved cable carrying an effective force of 180 kN. The beam supports a total UDL of 5kN/m which includes the self weight of the member. The beam is additionally prestressed by vertical cables imparting a stress of 2.5 N/mm^2 in the direction of the depth of the beam. Estimate the nature of principal stresses developed at the support section. The cable has zero eccentricity at supports and an eccentricity of 100 mm below CG at mid span section. **(12 Marks)**

OR

8 a. Explain the different methods of improving shear resistance of PSC members. **(08 Marks)**

b. The support section of a PSC beam 100 mm wide by 250 mm deep is required to support an ultimate shear force of 60 kN. The compressive prestress at centroid is 5 N/mm^2, fck = 40 N/mm^2, effective cover to reinforcement = 50 mm. If $f_y = 415$ N/mm^2, design suitable reinforcement in the section using IS : 1343 codal provisions. **(12 Marks)**

Module-5

9 a. Write a note on anchorage zone stresses. **(08 Marks)**

b. End block of PSC beam of rectangular section is 150 mm wide and 400 mm deep. An effective prestressing force of 400 kN is transmitted to concrete by a distribution plate of 150 mm wide and 120 mm deep concentrically located at ends. Calculate the maximum bursting force and design the reinforcement for the end block for maximum transverse tension. Sketch the reinforcement details. Use Fe 415 steel. **(12 Marks)**

OR

10 a. Write a note on anchorage zone reinforcement. **(08 Marks)**

b. End block of a post-tensioned beam is 300 mm wide by 300 mm deep and is prestressed concentrically by a Freyssinet cylindrical anchorage of 150 mm diameter with a Jacking force of 800 kN. Design suitable anchorage zone reinforcement and sketch the details. **(12 Marks)**

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